



POWERS AND ROOTS

NO CALCULATOR

CHANGE OF BASE

Ref: G133. **6R1**

A1 Write 5^8 as a power of 25	A2 Write 8^6 as a power of 2	A3 Write 8^6 as a power of 4	A4 Write $8^2 \times 4^3$ as a power of 2
B1 Write 2 as a power of 8	B2 Write 4 as a power of 8	B3 Write $\sqrt{8}$ as a power of 2	B4 Express $3\sqrt{3}$ as a power of 9
C1 Express $\frac{1}{81}$ as a single power of 3	C2 Express $\frac{1}{\sqrt{3}}$ as a single power of 9	C3 Express $\frac{1}{4\sqrt{2}}$ as a single power of 2	C4 Express $3^7 + 9^4 + 15 \times 27^2$ as a power of 3
D1 Solve: $32^x = \frac{1}{16}$	D2 Solve: $2^x = 8^{\frac{1}{4}} \times 16^{\frac{1}{3}}$	D3 Find the value of x if: $9^{\frac{3}{4}} \times 27^x = 81^{\frac{2}{3}}$	D4 Find the value of m and n if: $6 \times 12^m = 9^4 \times 2^n$



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<p>A1 Write 5^8 as a power of 25</p> $5^8 = 5^{2 \times 4}$ $= 25^4$	<p>A2 Write 8^6 as a power of 2</p> $8^6 = (2^3)^6$ $= 2^{18}$	<p>A3 Write 8^6 as a power of 4</p> $8^6 = (2^3)^6 = 2^{18}$ $= 2^{2 \times 9}$ $= 4^9$	<p>A4 Write $8^2 \times 4^3$ as a power of 2</p> $8^2 \times 4^3 = (2^3)^2 \times (2^2)^3$ $= 2^6 \times 2^6$ $= 2^{12}$
<p>B1 Write 2 as a power of 8</p> $2 = \sqrt[3]{8}$ $= 8^{\frac{1}{3}}$	<p>B2 Write 4 as a power of 8</p> $4 = 2^2 = \left(8^{\frac{1}{3}}\right)^2$ $= 8^{\frac{2}{3}}$	<p>B3 Write $\sqrt{8}$ as a power of 2</p> $\sqrt{8} = 8^{\frac{1}{2}} = (2^3)^{\frac{1}{2}}$ $= 2^{\frac{3}{2}}$	<p>B4 Express $3\sqrt{3}$ as a power of 9</p> $3\sqrt{3} = 3 \times 3^{\frac{1}{2}} = 3^{\frac{3}{2}}$ $= \left(9^{\frac{1}{2}}\right)^{\frac{3}{2}} = 9^{\frac{3}{4}}$
<p>C1 Express $\frac{1}{81}$ as a single power of 3</p> $\frac{1}{81} = \frac{1}{3^4} = 3^{-4}$	<p>C2</p> $\frac{1}{\sqrt{3}} = \frac{1}{3^{\frac{1}{2}}} = 3^{-\frac{1}{2}}$ $= \left(9^{\frac{1}{2}}\right)^{-\frac{1}{2}} = 9^{-\frac{1}{4}}$	<p>C3</p> $\frac{1}{4\sqrt{2}} = \frac{1}{2^2 \times 2^{\frac{1}{2}}} = \frac{1}{2^{\frac{5}{2}}} = 2^{-\frac{5}{2}}$	$3^7 + 9^4 + 15 \times 27^2 = 3^7 + (3^2)^4 + 15(3^3)^2$ $= 3^7 + 3^8 + 5 \times 3(3^6)$ $= 3^7 + 3^8 + 5 \times (3^7)$ $= 3^7(1 + 3 + 5)$ $= 3^7 \times 9$ $= 3^7 \times 3^2 = 3^9$
<p>D1</p> $32^x = \frac{1}{16}$ $\Rightarrow (2^5)^x = \frac{1}{2^4}$ $\Rightarrow 2^{5x} = 2^{-4}$ $\Rightarrow 5x = -4$ $\Rightarrow x = -\frac{4}{5}$	<p>D2</p> $2^x = 8^{\frac{1}{4}} \times 16^{\frac{1}{3}}$ $\Rightarrow 2^x = (2^3)^{\frac{1}{4}} \times (2^4)^{\frac{1}{3}}$ $\Rightarrow 2^x = 2^{\frac{3}{4}} \times 2^{\frac{4}{3}}$ $\Rightarrow x = \frac{3}{4} + \frac{4}{3} = \frac{25}{12}$	<p>D3</p> $9^{\frac{3}{4}} \times 27^x = 81^{\frac{2}{3}}$ $\Rightarrow (3^2)^{\frac{3}{4}} \times (3^3)^x = (3^4)^{\frac{2}{3}}$ $\Rightarrow 3^{\frac{6}{4}} \times 3^{3x} = 3^{\frac{8}{3}}$ $\Rightarrow 3x = \frac{8}{3} - \frac{6}{4}$ $\Rightarrow 3x = \frac{7}{6}$ $\Rightarrow x = \frac{7}{18}$	<p>D4</p> $6 \times 12^m = 9^4 \times 2^n$ $\Rightarrow 3 \times 2 \times (3 \times 2^2)^m = 3^{2 \times 4} \times 2^n$ $\Rightarrow 3^{m+1} \times 2^{2m+1} = 3^8 \times 2^n$ $m+1 = 8 \quad n = 2m+1$ $\Rightarrow m = 7 \quad = 15$